Service Manual

ARABELLA®

HAMILTON MEDICAL

This Service Manual may only be used in conjunction with the ARABELLA Operator's manual (Part number 610682/01).

Any warning, caution and note listed in the Operator's Manual must be read and understood prior to use this Service Manual!

For specifications and warranty please consult also the Operator's Manual of ARABELLA.

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TABLE OF CONTENTS

1 PNEUMATIC SYSTEM 3
1.1 Gas Inlet Block 3
1.2 Gas Blender 3
1.2.1 Nulling Regulator 3
1.2.2 Proportioning Valve 3
1.2.3 Bypass module 3
1.3 Flow Meter Assembly 3
1.3.1 Block Sub-Assembly 3
1.3.2 Flow Meter 3
1.3.3 Oxygen Cell 4
1.3.4 Patient Over Pressure Valve 4
1.3.5 Circuit Over Pressure Valve 4
1.4 Pressure Measurement 4
1.4.1 Proximal Pressure Port 4
1.4.2 Proximal Pressure Transducer 4
2 ELECTRONIC SYSTEM 5
2.1 Pressure Monitoring 5
2.2 Oxygen Monitoring 5
2.3 Alarm System 5
2.3.1 Buzzer 5
2.3.2 Alarm Switch (front panel) 5
2.3.3 Oxygen Set Point Potentiometer 5
2.4 Auto Dimming Feature 6
2.5 Patient Over Pressure Protection 6
2.6 + 15 Volt Monitoring 6
2.7 Reference Voltages 6
2.8 Test Points and Test SoftWare (TSW) 6
3 POWER SUPPLY 8
3.1 Power Supply Board 8
3.2 Power input Module 8
3.3 Load Resistors 8
4 CALIBRATION 9
4.1 Electronic Calibration 9
4.1.1 Trouble Shooting Tests 11
4.2 PNUEMATIC TESTS 14
4.2.1 FLOW METER / CPAP TEST 14
4.2.2 PATIENT OVERPRESSURE TEST 14
4.2.3 CIRCUIT OVERPRESSURE TEST 14
4.2.4 OXYGEN ANALYZER TEST 14
4.2.5 GAS MIXER TESTS 15
5 TROUBLESHOOTING GUIDELINES 16
6 PREVENTIVE MAINTENANCE 18
6.1 CLEANING and maintenance 18
6.2 PREVENTATIVE MAINTENANCE 18
6.2.1 Tools/Equipment's required for maintenance 19
6.2.2 Preventive Maintenance Procedure 18

1 PNEUMATIC SYSTEM

1.1 GAS INLET BLOCK

The ARABELLA driver is equipped with two gas inlets (DISS fittings) for air and oxygen sources at a nominal pressure of 3.45 bar (50 PSI). The unit will operate satisfactorily with inlet pressures of 2 - 5 bar (30 - 70 PSI) providing that the pressures are within 1.38 bar (20PSI) of one other. The air inlet contains a water trap and a 5 micron filter assembly which needs to be check as recommended in the Operator's Manual (Preventive maintenance schedule) . The gas inlet block is located at the left side of the rear panel. Two 3/16" allen head screws secure the gas block to the ARABELLA driver.

1.2 GAS BLENDER

The gas blender consists of three modules. They are the nulling regulator, proportioning valve and bypass module.

1.2.1 *Nulling Regulator*

The nulling regulators first function is to filter out any impurities from the air and oxygen. This is accomplished by two small sintered metal filters (5 micron). The next step is to prevent cross contamination of the gas sources with two "duck bill" valves. These duck bills prevent one gas source from back feeding through the gas blender. The last function is to compensate for unequal air/oxygen source pressures. Equal input pressures will result in equal gas flow from the air and oxygen sides of the nulling regulator. Input pressure imbalances will be compensated for by restricting the orifice on high pressure side and allowing the lower pressure side orifice to open more. This will provide consistent gas sources to the proportioning valve for input pressure variations of up to ± 1.38 bar (20 PSI) max.

1.2.2 *Proportioning Valve*

The proportioning valve is the module that blends the air and oxygen . The oxygen is set by the control knob on the right front of the ARABELLA. This knob controls a small metal cylinder that is tapered from the middle to each end (like a football). The position of this football proportions the gas flow from the air and oxygen outputs of the nulling regulator. This blended gas is then delivered to the flow meter block and the auxiliary output on the bottom of the ARABELLA.

1.2.3 *Bypass module*

In the event of a pressure differential of greater than 1.66 bar (24 PSI) at the gas inputs, the bypass module will perform 2 functions. One will be to bypass the low gas source and allow only the higher pressure source to be delivered out of the patient port. The other will be to provide a flow of gas to the reed alarm. This audible alarm will notify the user of a gas source failure.

1.3 FLOW METER ASSEMBLY

1.3.1 *Block Sub-Assembly*

The Block Sub-Assembly controls gas flow to the patient and oxygen cell. This assembly also contains the patient over pressure solenoid and circuit over pressure valve.

1.3.2 *Flow Meter*

The Flow Meter controls gas flow from the gas blender to the patient. In clinical use 8L/pm should deliver 5cmH_2O.

1.3.3 *Oxygen Cell*

The oxygen cell is a galvanic oxygen cell. It obtains a side stream sample of blended gas from the gas blender and exhausts this sample gas out of the rear panel. This exhaust port is protected by a small brass filter. The oxygen cell requires a two point calibration for proper operation. This cell is replaced at the annual preventative maintenance.

1.3.4 *Patient Over Pressure Valve*

The Patient Over Pressure Valve is an electronically controlled solenoid. In the event of a patient over pressure, this solenoid diverts gas flow from the patient to the rear panel exhaust port. The exhaust port is protected with a small brass filter.

1.3.5 *Circuit Over Pressure Valve*

The Circuit Over Pressure Valve is a spring loaded pressure relief device. If the Patient Port or the patient circuit is occluded, the valve will open at a preset pressure of 150 cmH_2O. The gas flow will be diverted for the duration of the occlusion.

1.4 PRESSURE MEASUREMENT

1.4.1 *Proximal Pressure Port*

The proximal pressure port is located on the bottom of the ARABELLA driver below the electronic module (left side). It is a female luer type connector.

1.4.2 *Proximal Pressure Transducer*

The pressure transducer is mounted to the main circuit board. It has a two point calibration (offset – gain). The offset will be calibrated to 1 cmH_2O and the gain to 10 cmH_2O. The offset is calibrated at 1 cmH_2O to obtain maximum accuracy as the pressure transducer gain ramp has a sharp drop at the zero point.

2 ELECTRONIC SYSTEM

2.1 PRESSURE MONITORING

The NCPAP is measured via the Proximal Pressure Port on the bottom of the ARABELLA Driver. This Proximal Pressure Port is connected to the pressure transducer (U5). This signal is amplified by U4 and U9. The gain at U4 is fixed (R3). The pressure transducer zero (offset) is adjusted with R48 and the gain is adjusted with R46. A zener diode (D26) is used at U9 signal output to prevent an over voltage at the input of the ADC (U7) in the event of an overpressure or vacuum at the Proximal Port.

The digitized signal is then multiplexed at U10 and displayed on a LED Bar Graph. This bar graph is called the Pressure Manometer.

In operating mode this Pressure Manometer will only activate after the system acknowledges 2 cmH_2O at the Proximal Port for 3 seconds. Once the manometer is activated, the pressure will display continuously, regardless of the proximal pressure.

2.2 OXYGEN MONITORING

The Oxygen Monitoring begins with the Oxygen Cell. The ARABELLA uses a galvanic O_2 cell that is mounted on the Flow meter Block. The connection at the cell is the three pin Molex variety and this harness connects to the Main Circuit Board at connector # P4. A two point calibration is required.

The Oxygen signal is then amplified by U11 with a fixed gain set by R43 and R44. The input of U11 also is connected to R42. This will allow the signal to go to 0V and trigger an Oxygen alarm in the event of a disconnected Oxygen Cell.

The two point Oxygen Cell calibration is performed at U6 using R50 for the 21% and R45 for the 100%.

The signal is the processed at an ADC (U7) and multiplexed at U8 for display on three 7 segment LED's.

2.3 ALARM SYSTEM

2.3.1 *Buzzer*

The Buzzer (DS1) is controlled by the microprocessor (U7) via a FET (Q1). The power is supplied from the 5 volt supply. The 15 volt supply is used as a backup with a zener diode (D23) to provide power in the event of a 5 volt failure.

2.3.2 *Alarm Switch (front panel)*

The alarm switch is used in several functions. It serves as a 30 second silence during low/high Oxygen and low/high pressure alarms. (See alarm section for additional alarm information)
The oxygen and pressure alarm points can be set by pressing and holding the alarm button for 3 seconds. When this step is performed the alarm LED's will flash and a series of beeps will be heard. The switch is also used for activating Test Software (TSW).

2.3.3 *Oxygen Set Point Potentiometer*

This potentiometer (R blender) is located at the gas blender control setting. It is secured to the front of the blender and it tracks the blender setting via 2 sprockets. One secured to the blender shaft and the other to the Oxygen Set Point Potentiometer. A change in gas concentration results in a corresponding change in resistance. This allows the processor to know the "set point" for the oxygen concentration alarms. The potentiometer is calibrated using R47 for the offset and R49 for the gain. R19 will force the amplifier input to 0 volts in the event of a potentiometer disconnection or failure. This will cause an

Oxygen Nominal Alarm. This alarm cannot be silenced.

2.4 AUTO DIMMING FEATURE

The light "brightness" is measured using an optical sensor (U4). This signal is amplified with U6 and then processed by the ADC in U7. A zener diode (D25) is used to protect the ADC input from over voltage. The display brightness will be 100% for ADC values of 50 and greater and 50% for ADC values of 35 and less.

2.5 PATIENT OVER PRESSURE PROTECTION

The Patient Over Pressure Protection Valve is a normally closed solenoid controlled by the microprocessor. If the Proximal Pressure exceeds a pressure of 11 cmH_2O the microprocessor will activate the solenoid. This allows the gas flow selected at the flow meter to flow through the solenoid and out of a brass sound absorber on the rear panel, the path of least resistance. The patient pressure at this point would drop to zero. After 3 seconds the processor will attempt to restore flow to the patient circuit. If the over Pressure condition is still present the solenoid will open again. This process will repeat until the condition is cleared.

The solenoid is mounted on the Flow Meter Block and is connected to the Main Circuit Board at connector #P5. It is activated by a FET (Q3)

2.6 + 15 VOLT MONITORING

The + 15 volt supply is monitored with R38 and R39 in series across the +15 volt supply and 15v ground. The voltage at the node is input to the ADC where the digital value is monitored. The value must keep the + 15 volt at $\pm$ 10% tolerance. Failure to do so will result in a watch dog reset of the microprocessor.

The –15 volt supply is monitored with R40 and R41 in series across the –15 volt supply and the +10 volt reference. The + 10 volt reference allows the node voltage to be positive to accommodate the ADC input (input can not be negative). This digital value is monitored to verify that the -15 volt supply remains within the $\pm$10% tolerance. Failure to do so will result in a watch dog reset of the microprocessor.

2.7 REFERENCE VOLTAGES

V ref +4.76 Volts $\pm$0.03V

V ref is derived with R4, R7 and U6. The voltage at the node of voltage divider R4 and R7 is driven by U6, a high input impedance op amp.

Precision Voltage $\pm$10.00 Volts

The +15 volt supply used by U2 to deliver a stable 10 volt output. U1's function is the driver for both the $\pm$ 10 volt supply. The output of U2 is stable at voltages down to +12 volts.

2.8 TEST POINTS AND TEST SOFTWARE (TSW)

The test points are located at P6. Pin 1 is located at the top of the connector, 13 at the bottom.

P6 / 1	Ground
P6 / 2	Pressure signal – To ADC
P6 / 3	Reference voltage +4.76 V $\pm$0.03V
P6 / 4	+15 V control voltage to ADC

P6 / 5 - 15 V control voltage to ADC
P6 / 6 Oxygen set point to ADC (nominal alarm)
P6 / 7 Optical sensor output voltage to ADC
P6 / 8 +5 volt – Digital Power
P6 / 9 +15 volt – Analog Power
P6 / 10 Oxygen Cell voltage to ADC
P6 / 11 -15 volt – Analog Power
P6 / 12 +10 volt – Analog Precision Voltage
P6 / 13 -10 volt –Analog Precision Voltage

Test Software Switch (TSW)

The Test Switch is a 16 position, 4 line Hexadecimal code switch. To enable TSW the following steps must be followed:

1. Place switch in position 1
2. Press and hold the ALARM key on the front panel.
3. Turn Main Power on
4. Release ALARM switch after software revision is displayed.
5. Follow instructions in section 8.

3 POWER SUPPLY

3.1 POWER SUPPLY BOARD

The ARABELLA power supply module is a switching power supply providing the following outputs:

+5 volts	3 amp max output
+15 volts	2 amp max output
-15 volts	0.3 amp max output

The power supply input specifications are:

3.2 POWER INPUT MODULE

The power input module is a class B filter type suitable for medical use. The power input module also contains the primary fuses rated at 2 amp slow blow (2AT).

3.3 LOAD RESISTORS

The load resistors are located on the bracket forward of the power supply module. They are used as additional load on the power supply module to allow maximum efficiency of the switching supply.

4 CALIBRATION

The electronic calibration must be performed by qualified personnel. The following procedure will be completed during the annual preventative maintenance and repairs of the ARABELLA.

ELECTRONIC CALIBRATION SET UP

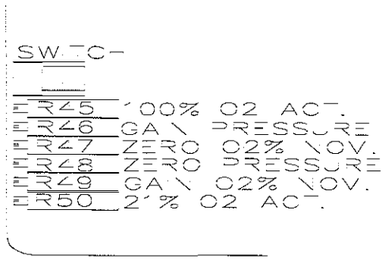
1. Disconnect AC power and Gas Sources.
2. Remove ARABELLA from the I.V. stand if attached.
3. Remove two screws at pole mount on right side of unit.
4. Remove five screws on bottom enclosure.
5. Remove top enclosure.
6. Re-secure pole mount to the right side of the unit.
7. Attach unit to I.V. stand and connect AC power.
8. With power OFF, set the test switch (TS 1) to position 1. The test switch is located on the left side of the unit, above the calibration potentiometers.
9. Press and hold the Alarm Reset Button on the front panel and turn the main power switch ON.
10. After the Software Version has been displayed on the oxygen display, release the Alarm Reset Button.
11. The ARABELLA is now in test mode.

4.1 ELECTRONIC CALIBRATION

TS1 Oxygen Cell Calibration

At position 1, the oxygen display shows the actual oxygen value x2. This value is from the ADC converter and allows the 2-point calibration of the oxygen cell.

-Connect air and oxygen. Display reads 2x oxygen value.
-Set oxygen knob to 100%, allow 1 minute to stabilize.
-Adjust 100% calibration potentiometer (100% O2 ACT.) for display of 200.
-Set oxygen knob to 21%, allow 1 minute to stabilize.
-Adjust 21% calibration potentiometer (21% O2 ACT.) for display of 42-43.
-Repeat steps until no adjustment is required.



TS2 Oxygen Blender Alarm Position Potentiometer Calibration

The blender alarm potentiometer's function is to allow the microprocessor an electronic method of determining where the gas blender is set to for comparison to the actual oxygen value. A nominal oxygen alarm would result if the values did not coincide.

At position 2, the oxygen display will show the blender alarm potentiometer value x2. This value is from the ADC converter and allows the blender potentiometer to be calibrated to the gas blender.

-Turn test switch to position 2.
-Display reads 2x the effective value.
-Set oxygen concentration to 100 %.
-Adjust gain O2 nominal potentiometer (GAIN O2%NOM.) for display of 200.
-Set oxygen concentration to 21%.
-Adjust zero O2 nominal potentiometer (ZERO O2% NOM.) for display of 42-43.
-Repeat steps until no adjustment is needed.

TS3 Pressure Manometer Calibration

At position 3, the ADC will convert the analog pressure transducer output to a digital signal for the oxygen display. The display will read x 16 the effective value. The LED display is scaled from 0 – 12 cmH_2O. A two-point calibration is required.
** The display value cannot be negative and cannot be greater that 255.**
Zero Pressure potentiometer must be calibrated at 1 cmH_2O (16 on display).

-Connect test set up in diagram 1.
-Set pressure to 10 cmH_2O.
-Adjust Gain Pressure potentiometer (GAIN PRESSURE) for a value of 160 $\pm$ 1.
-Set pressure to 1 cmH_2O.
-Adjust zero pressure potentiometer (ZERO PRESSURE) for a value of 16 $\pm$ 1.
-Repeat steps until no adjustment is required.

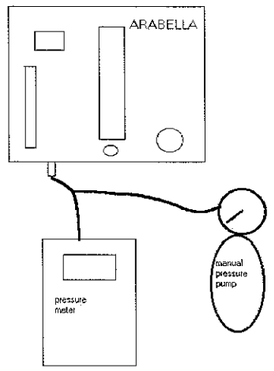


Diagram 1

TS 4 Display Auto-Dimming Check

At position 4, the digital display will show a value from the ADC indicating the brightness level of the LED displays.

-Display value above 50 = Max intensity.
-Display value below 35 = Low intensity.

TS5 + 15 Volt Analog Supply Check

At position 5, the digital display will indicate a value from the ADC. If the value is out of range for longer than 50 ms, a watchdog reset is executed.

-Display value range 189 – 231.

TS6 - 15 Volt Analog Supply Check

At position 6, the digital display will indicate a value from the ADC. If the value is out of range for longer than 50 ms, a watchdog reset is executed.

-Display value range 59 – 113.

4.1.1 *Trouble Shooting Tests*

TS7 – TSC Oxygen and Pressure Alarm Set Points and Low/High Alarm Points.

The sequence of tests 7 – C will check the alarm set points programmed by holding the ALARM RESET button for 3 seconds. In clinical application this point is set after proper patient setup. In calibration mode it allows the technician to verify the pressure and oxygen set point as well as the low and high alarm points.

Oxygen Alarm Test

- Set test switch to position 2.
- Set oxygen to 100 on the digital display .
- Press alarm reset button for 3 seconds. (Audio alarm)
- Return to position 7.
- The displayed value is the *set point.*
- Position 8 is the High Limit value. This value must be 9 higher than the *set point.*
- Position 9 is the Low Limit value. This value must be 9 lower than the *set point.*

Pressure Alarm Test

- Set test switch to position 3
- Apply 5 cmH_2O to the proximal pressure port. The digital display will indicate 16 x the pressure of 5 cmH_2O (80).
- Press the alarm reset button for 3 seconds. (Audio alarm).
- Return test switch to position "A". This is the *set point* .
  The *set point* cannot be >128.
- Set test switch to position "B".
  The displayed value is the high alarm limit. It should read 48 higher than the *set point.* The high limit cannot be > 176.
- Set the test switch to position "C".
- The displayed value is the low alarm limit. It should read 32 lower than the *set point* .
  The low limit cannot be < 16.

TS"C" Watch Dog Reset

- Place test switch in position "C".
- Press the alarm reset button. This creates a stop function at the microprocessor causing a watch dog reset. The device will go through it's start up sequence. (lamp test, audio alarm and the software revision display)

TS"D" Circuit Over Pressure Solenoid Test

- Place test switch in position "D". Turn the unit OFF and ON (Back into test software).
- The over pressure solenoid will cycle 3 seconds ON, 3 seconds OFF.

TS"E" Display, Buzzer & Photo Cell Tests

- Place test switch in position "E".
- The digital display will count from 0-255.
  NOTE: The display will start the count at some point > 0.

1 Digital Display Test
- Press the alarm reset button.
  The digital display will count the 1's digit 0-9 (9 will remain displayed).
  The 10's digit will count from 0-9. (9 will remain displayed)
  The 100's digit will count from 0-9.
  The test will repeat.

2 Bar Graph Test
- Press the alarm reset button.
  0 cmH_2O – 12 cmH_2O will illuminate individually, then all together.
  Test will repeat.

3 LED test
- Press alarm reset button.
  Digital display not illuminated, all individual LED's ON.

4 Seven Segment LED Test
- Press the alarm reset button.
  Digital display will be illuminated, all individual LED's will be OFF.

5 Display Test
- Press the alarm reset button.
  The digital display and the individual LED's will be ON.

6 Display Test II
- Press the alarm reset button.
  The digital display and individual LED's will be OFF.

7 Photo Cell Test
- Press the alarm reset button.
  Oxygen display shows the brightness value.
  All alarm LED's ON and the bar graph is OFF.
  Remark: Bright light 255 / no light 0.

8 Alarm LED Test
- Press the alarm reset button.
  Oxygen display shows 8 and Oxygen High Alarm LED is ON.

- Press the alarm reset button.
  Oxygen display shows 9 and Oxygen Low Alarm LED is ON.

- Press the alarm reset button.
  Oxygen display shows 10 and Alarm Reset LED is ON.

- Press the alarm reset button.
  Oxygen display shows 11and High Pressure Alarm LED is ON.

- Press the alarm reset button.
  Oxygen display shows 12 and Low Pressure Alarm LED is ON.

- Press the alarm reset button.
  Oxygen display shows 13 and Audio alarm is activated.

- Press the alarm reset button.
  Oxygen display shows 14 and Audio alarm is OFF.

- Press the alarm reset button.
  Oxygen display shows 15 and Over pressure valve cycles ON / OFF.
  (10 second interval)

- Press the alarm reset button.
  Oxygen display shows 16 and Over Pressure Valve cycling stops.

- Press the alarm reset button.
  Oxygen display shows .17.

- Press the alarm reset button.
  Oxygen display counts from 0 up to 255 and back to zero. Every 16 counts the bar graph is increased by one respectively decreased by one.
  Remark: 208 - 255 -208 the bar graph is completely illuminated.

TS"F" SYSTEM Reset

- Place test switch in position "F".
- Press the alarm reset button.
  Watch dog reset occurs and unit will complete start up sequence.

→ Return to position "0"

4.2 PNUEMATIC TESTS

For the following pneumatic test the ARABELLA must be connected to the gas sources and the mains power.

4.2.1 *FLOW METER / CPAP TEST*

Connect a complete patient circuit to the patient outlet and occlude the prongs with your fingers to verify the following pressure values in the display:

6 LPM => **3 cmH_2O**
7 LPM => **4 cmH_2O**
8 LPM => **5 cmH_2O**
9 LPM => **6 cmH_2O**
10 LPM => **7 cmH_2O**

→ Remove prongs and verify the manometer drops to **0 cmH_2O**.

4.2.2 *PATIENT OVERPRESSURE TEST*

- Set flow meter to 8 LPM.
- Occlude the prongs to simulate patient (approx. 5 cmH_2O).
- Create a momentary overpressure condition by closing the expiration line and verify the pressure manometer drops to **0 - 1 cmH_2O** immediately.
- Verify visual and audible High Pressure alarms.
- Release the expiration line
- After 3 seconds the patient gas flow will resume. Confirm that the manometer indicates the proper pressure and the High Pressure Alarm is cleared.

4.2.3 *CIRCUIT OVERPRESSURE TEST*

- Remove the hose connected to the ARABELLA patient outlet.
- Connect the patient outlet to a Pressure Controller.
- Verify the pressure measurement. The reading must be **150 cmH_2O ± 10 cmH_2O**.
- Disconnect the hose from the patient outlet and reconnect the patient circuit hose.

4.2.4 *OXYGEN ANALYZER TEST*

Keep the flow meter setting at 8 LPM and verify the following oxygen readings:

Setting (O_2%)	Reading
40	**39 - 41**
60	**58 - 62**
80	**78 - 82**

Remark: Refer to Operator's Manual for Oxygen cell calibration procedure.

4.2.5 *GAS MIXER TESTS*

Important Note: Do not connect a patient circuit for the following tests!

- Make sure both inlet gas supplies are adjusted to 50PSI.
- Set the mixer to 60% (Allow the oxygen monitor 1 minute to stabilize).
- Verify oxygen display is 60 ± 3% (Reference value).
- Set the air inlet pressure to 30 PSI and keep the oxygen at 50 PSI.
- Verify the oxygen display: The oxygen reading must remain the same as with equal inlet pressures. The accepted range is: Reference value +/- 2%.
- Set the air inlet pressure to 50 PSI and the oxygen inlet to 30 PSI.
- Verify the oxygen display: The oxygen reading must remain the same as with equal inlet pressures. The accepted range is: Reference value +/- 2%.

Remark: Remove the pole mount assembly, replace top enclosure and re-secure the pole mount assembly when testing is finished.

5 TROUBLESHOOTING GUIDELINES

ALARM	INDICATION	SOLUTIONS
Low pressure indicator light with audible alarm	Low CPAP level	1. Prongs are not in proper position 2. Check for a disconnect or occlusion in patient circuit 3. Prongs are too small for baby's nose 4. Alarm was not reset when CPAP level decreased 5. Prongs are not attached properly to generator 6. Infant losing pressure from the mouth (may use pacifier to achieve proper seal) 7. Notify medical maintenance to check Driver.
High pressure indicator light with audible alarm	High CPAP level or overpressure in the system	1. Check for an occlusion or kink in the expiratory line 2. Check circuit for kinks or occlusion 3. Check nasal prongs for mucous plug 4. Alarm limit was not reset when CPAP level increased.
Low oxygen indicator light with audible alarm	FiO_2 too low for blender setting	1. Recalibrate the oxygen analyzer 2. Oxygen supply disconnected or pressure low in oxygen supply source 3. Oxygen concentration changed and alarm not reset. Press and hold Alarm key pad for three (3) seconds. 4. Oxygen fuel cell needs to be replaced
High oxygen indicator light with audible alarm	FiO_2 too high for blender setting	1. Recalibrate the oxygen analyzer 2. Air supply disconnected or pressure drop in the air supply source 3. Oxygen fuel cell needs to be replaced 4. Oxygen concentration changed and alarm needs to be reset. 5. Notify medical maintenance to check for damage to potentiometer during analyzer calibration.
- - - in the Oxygen display with Low Oxygen indicator and audible alarm	< 18% Oxygen	1. Check the O_2 setting on the blender 2. Recalibrate the oxygen analyzer 3. Oxygen fuel cell needs to be replaced
No pressure reading	No pressure display	1. Connect proximal pressure line to driver 2. Check circuit for leaks
Err in the Oxygen display with High Oxygen indicator and audible alarm	>+10% Oxygen value between the display and blender	1. A difference of >+10% is found in the potentiometer setting for the blender, recalibrate the oxygen analyzer
Err in the Oxygen display with Low Oxygen indicator and audible alarm	>-10% Oxygen value between the display and blender	1. A difference of >-10% is found in the potentiometer setting for the blender, recalibrate the oxygen analyzer

ALARM	INDICATION	SOLUTIONS
High pressure indicator light with audible alarm and pressure at 0 pressure	Pressure > 11 cmH_2O	1. Pressure exceeded preset limit 2. Check for occlusion or kink in the proximal pressure line 3. Check for occlusion of the expiratory limb extension
--- in the Oxygen display with High and Low indicator and audible alarm	Disconnect of the blender knob from the blender	1. Check connections
No audible alarm No visual display	Power failure to the driver	1. Power on the driver 2. Verify electrical connection

6 PREVENTIVE MAINTENANCE

6.1 CLEANING AND MAINTENANCE

For cleaning and maintenance please check to see the operator's manual section 6.

6.2 PREVENTATIVE MAINTENANCE PROCEDURE

A qualified service engineer should perform preventative maintenance at least every twelve (12) months. The annual preventative maintenance consists of **replacing parts included in Preventative maintenance kit → P/N 34001** and **a complete calibration procedure as listed in Section 4 in this manual.**

The **Preventative maintenance kit** consists of the following items:

Items in P/N 34001	Quantity	Part number
Mixer filter kit	2	32014
Brass silencer	3	281071
Air inlet filter	1	279676
Oxygen cell	1	396008

6.2.1 *Parts replacement procedure*

1. Remove AC power cord from power entry module.
2. Disconnect air and oxygen hoses from gas sources and ARABELLA gas inlet block.
3. Remove two 3/16" ASA allen screws at the gas block.
4. Remove the gas inlet block from the ARABELLA by pulling straight back on the air/oxygen DISS fittings.
5. Remove the five screws on the bottom outer edge of the ARABELLA case, securing the top enclosure (3 on the left, 2 on the right).
6. Remove the two screws holding the pole mount assembly to the right side of the ARABELLA.
7. Remove the top enclosure (Watch out for ESD).
8. Re-secure the pole mount assembly to the gas blender right side and place the ARABELLA on the pole stand for testing.
9. Disconnect the O2 cell harness and remove the O2 cell by unscrewing it from the flow meter block.
10. Remove and replace the two brass silencers at the rear of the ARABELLA (located at the back end of the flow meter block).
11. Remove and replace the brass silencer at the bottom of the ARABELLA (located next to the oxygen DISS fitting).
12. Remove the oxygen metal micron inlet filter assembly retainer at the rear of the gas blender (1/4" allen wrench) and remove the metal micron filter, spring and O-ring. (The O-ring is located inside the brass retainer.)
13. Install the new metal micron filter kit containing: O-ring, filter and spring. Re-secure the oxygen filter assembly retainer.
14. Remove the air metal micron inlet filter assembly retainer at the rear of the gas blender (1/4" allen wrench) and remove the metal micron filter, spring and O-ring. (The O-ring is located inside the brass retainer.). Re-secure the oxygen filter assembly retainer.

    Note: Inspect airside parts carefully! Visible signs of contamination could indicate airside maintenance needs to be performed more frequently to avoid future gas blender problems!

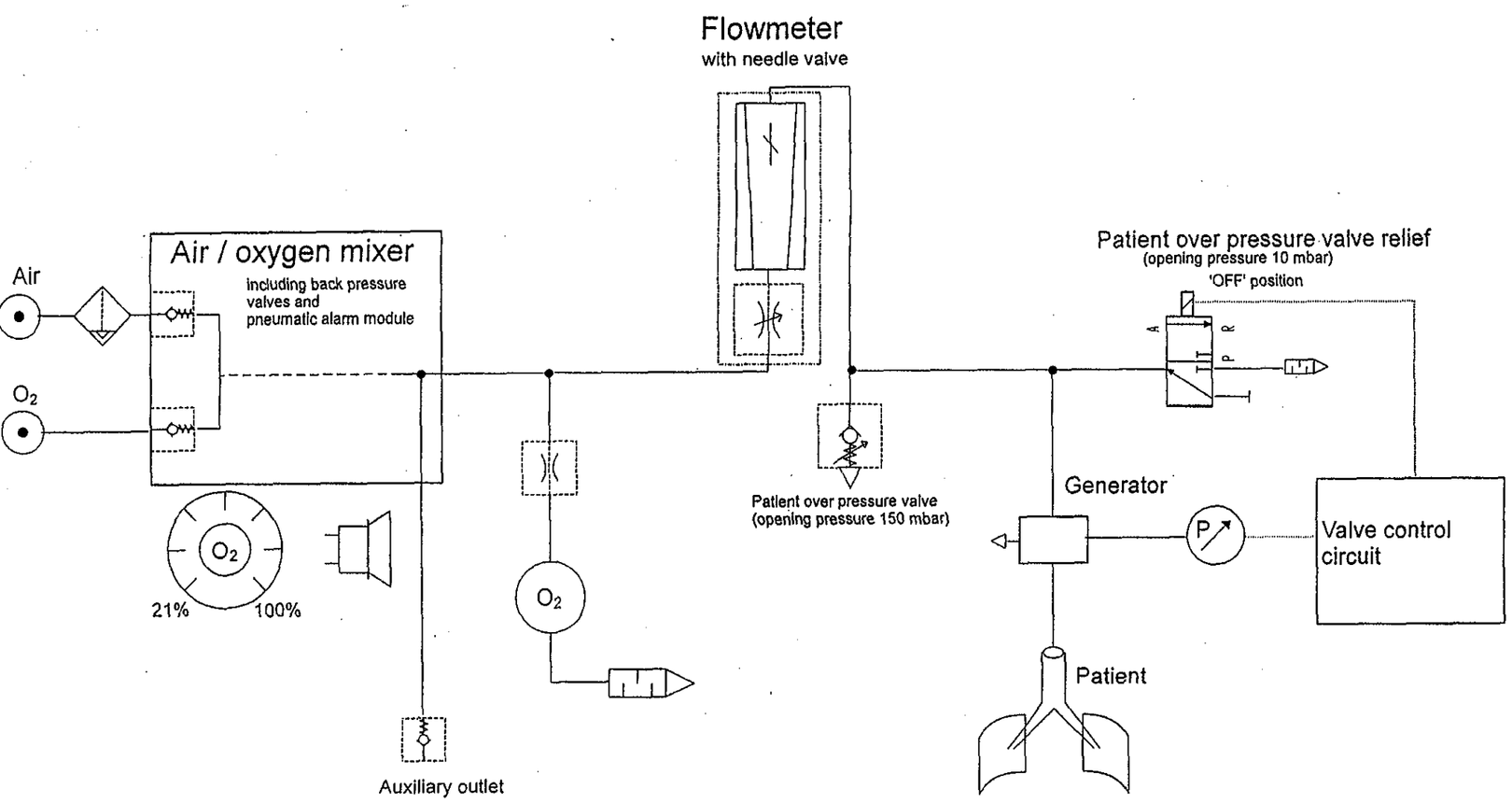
15. Install the new metal micron filter kit containing: O-ring, filter and spring. Re-secure the air filter assembly retainer.
16. Remove the water trap bowl, water trap O-ring and air inlet filter element.
17. Install new air filter element and O-ring. Clean the water trap bowl and re-secure.
18. Reinstall the gas inlet block.

19. Discard all old parts.
20. Perform all calibration test listed in section 4 of this manual.
21. Remove the pole mount assembly, replace top enclosure and re-secure the pole mount assembly.

6.2.2 *Tools/Equipment's required for maintenance*

Following tools/equipment's are required to perform an adequate maintenance of the ARABELLA:

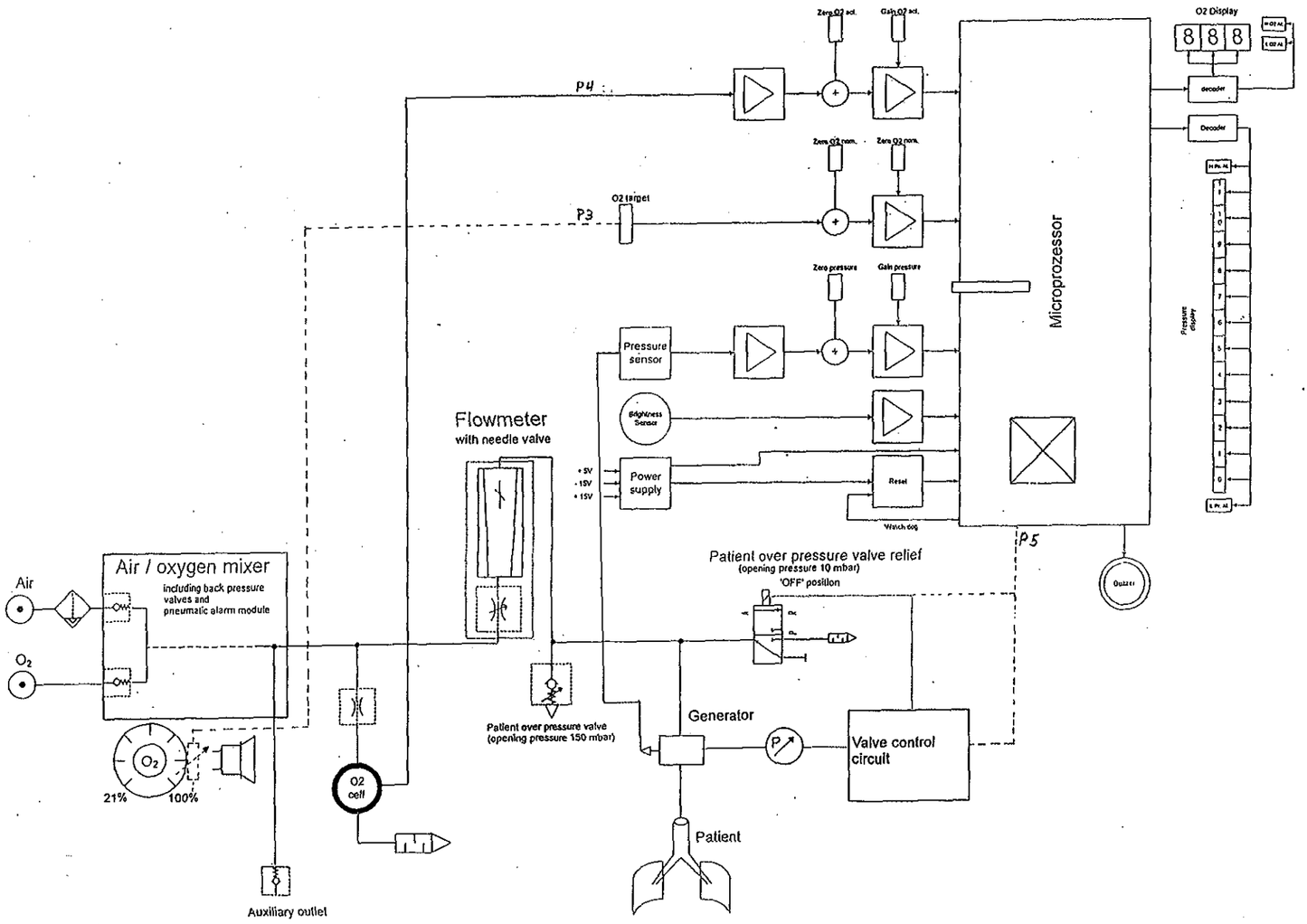
- ARABELLA Operator's Manual
- ARABELLA Service Manual
- ASA Allen Wrench set - up to 3/16"
- Metric Allen Wrench set - up to 5 mm
- Straight blade screwdriver - 3/16" tip
- Needle nose pliers
- Digital Volt meter
- Pressure Controller
- Adjustable Pressure Regulator (Air & Oxygen)
- Manual pump
- Miscellaneous: tubing, "T" fitting, male luer fitting, patient tubing system



Pneumatic Diagram		Format A4	Blatt 1 von 1
	Gez.	Heinz Pokorny	1999-06-02
	Gepr.	99-6-2	1999-06-02
HAMILTON MEDICAL AG	SA 604.128		Rev. 01

Hamilton Medical AG

BABYVENT
Electronic hardware blockdiagram



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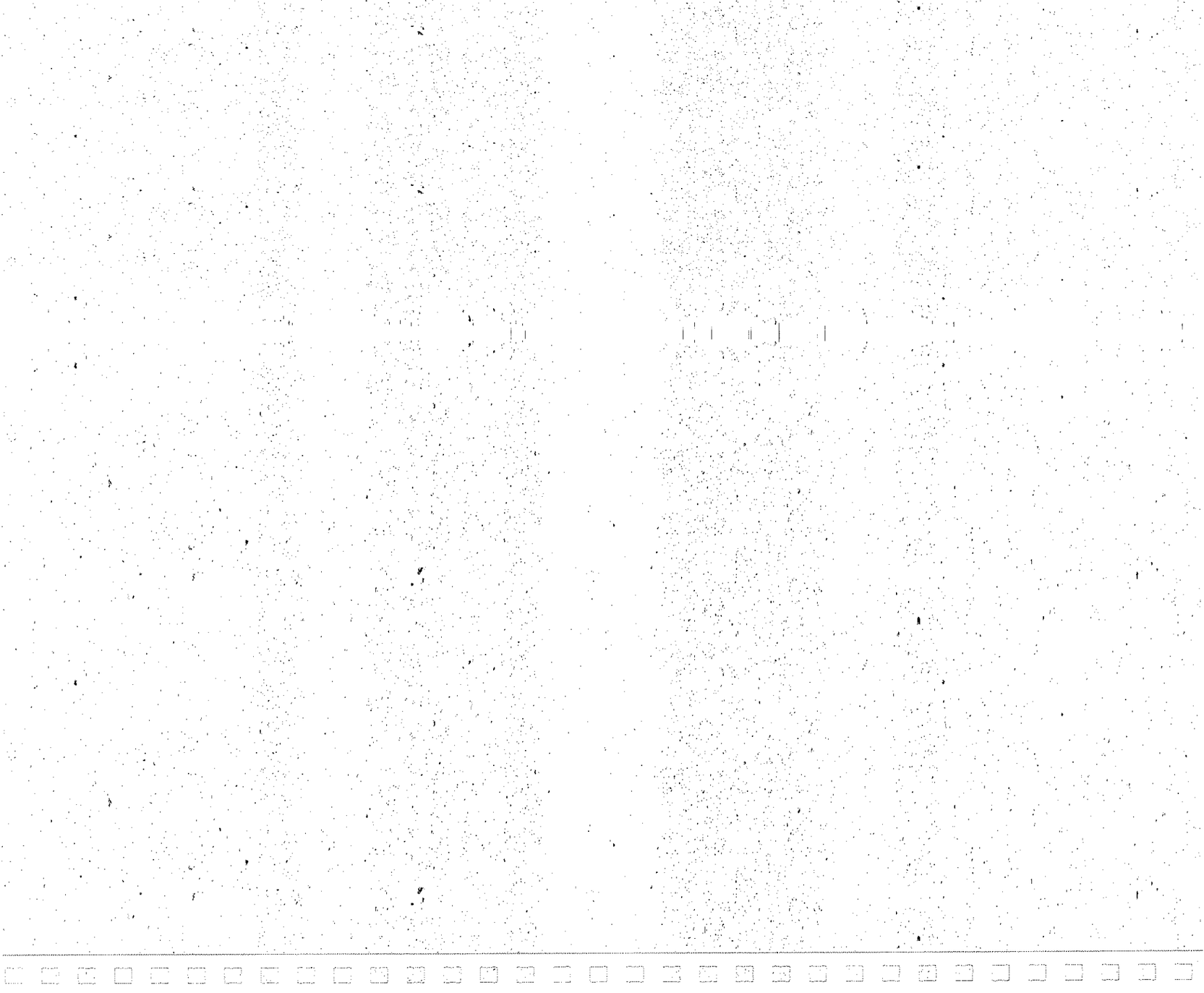
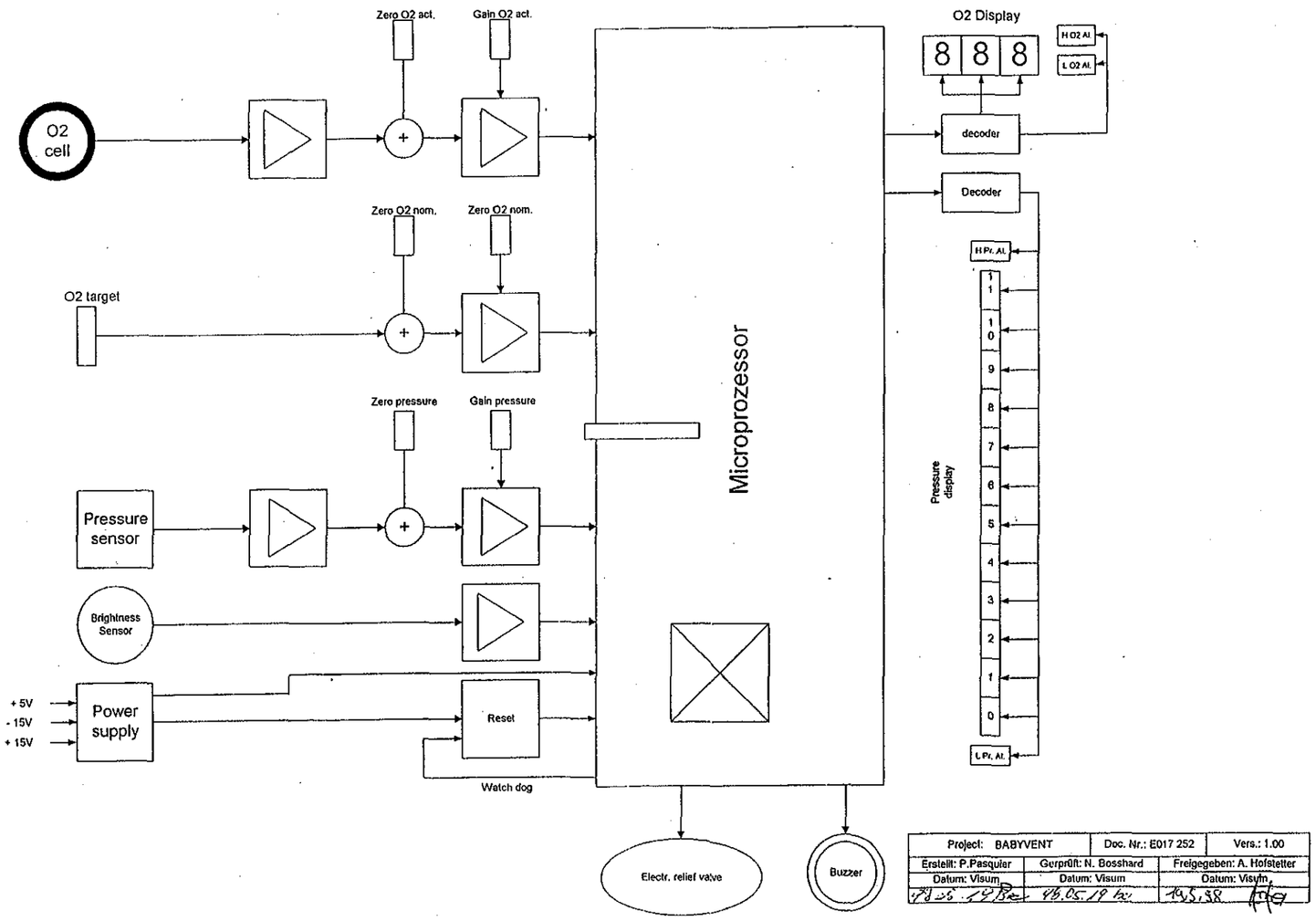
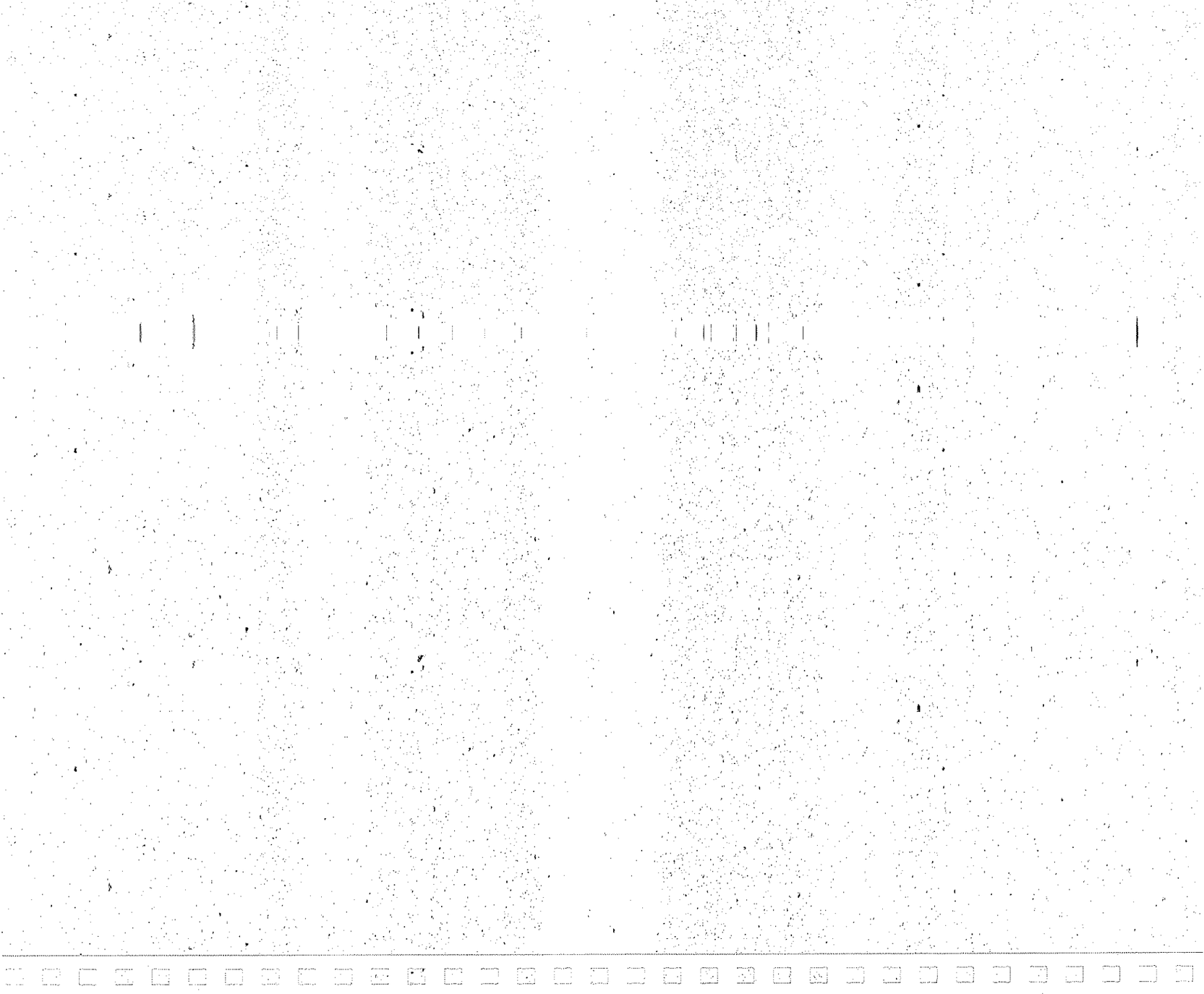
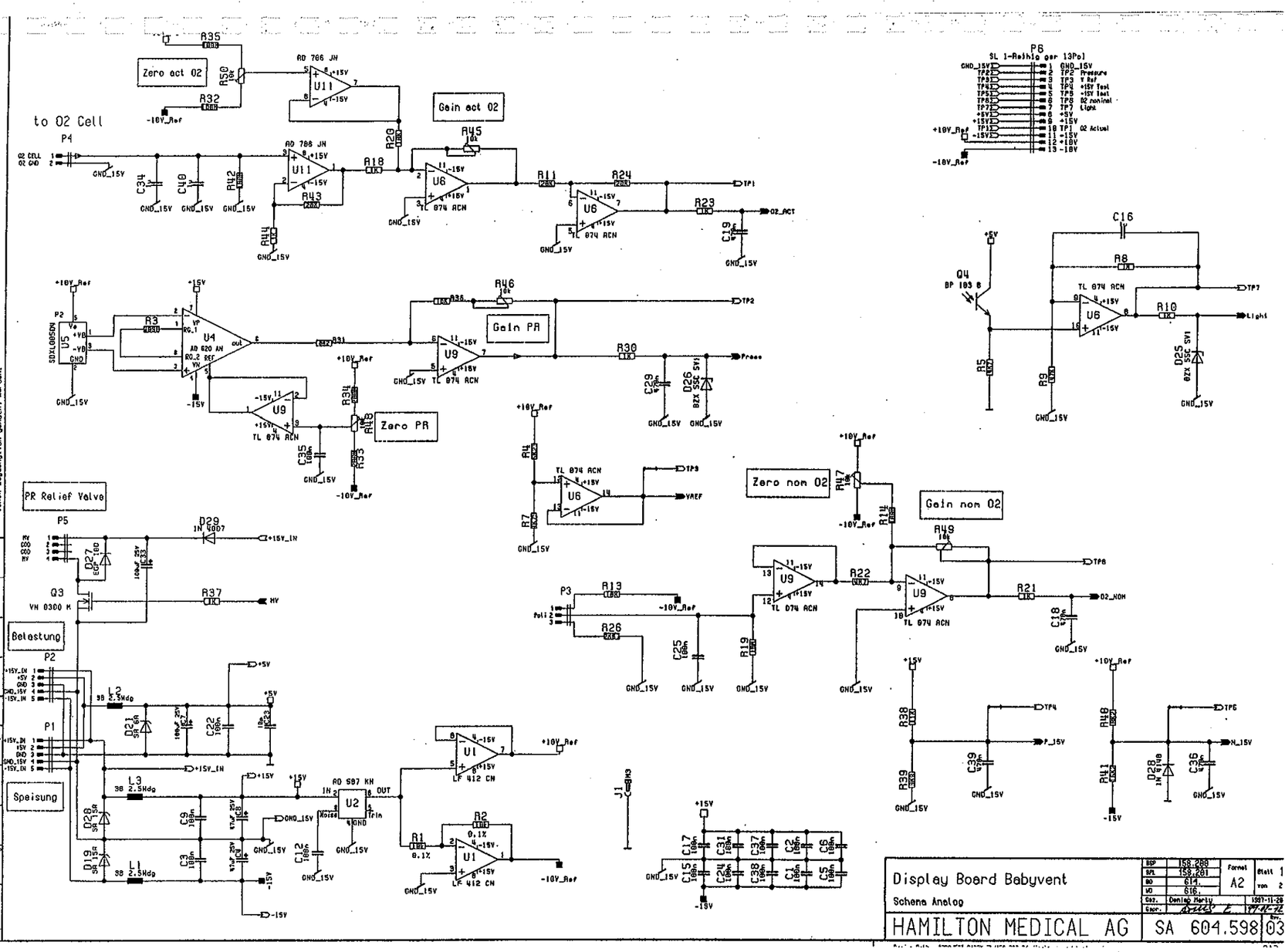


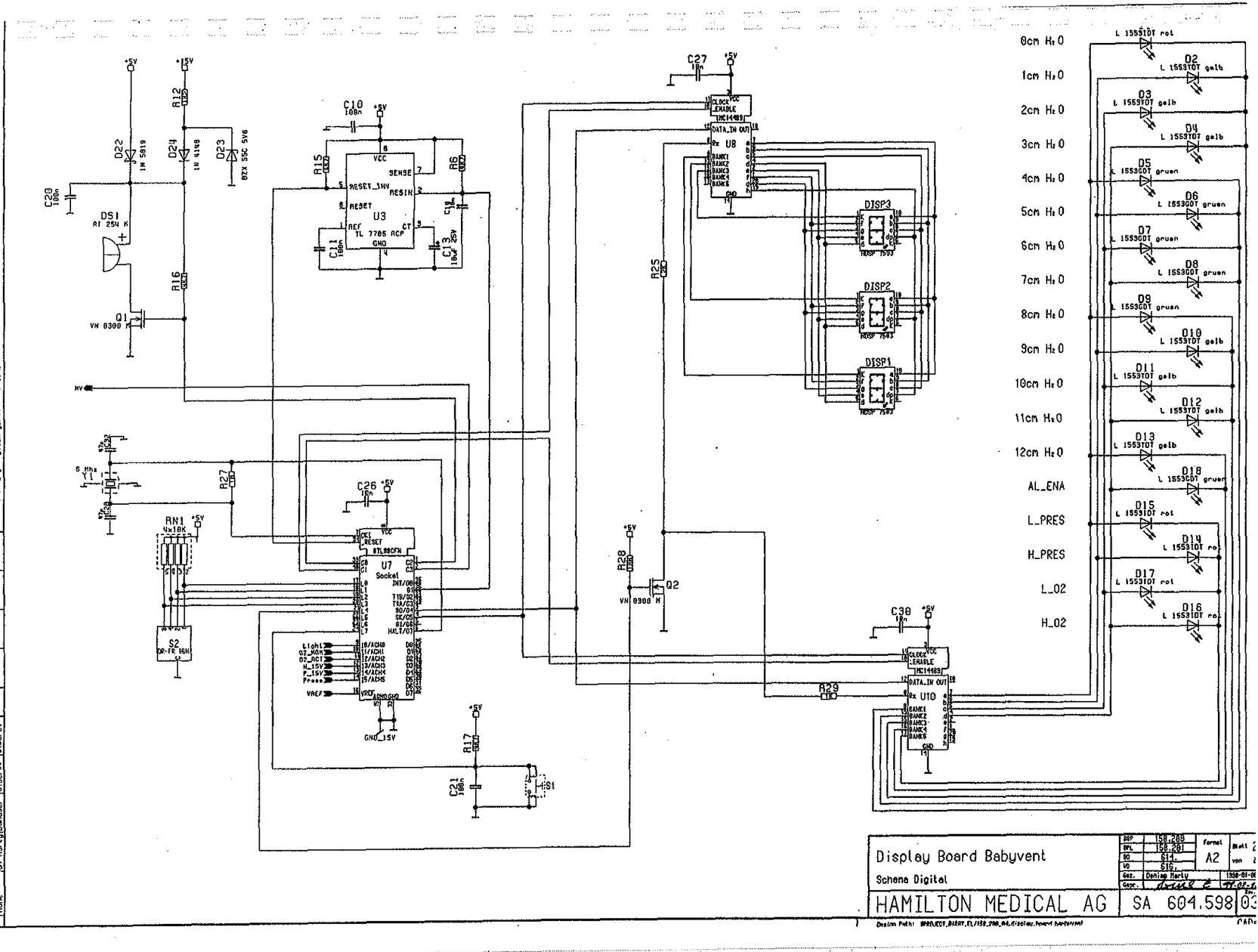
Hamilton Medical AG

BABYVENT
Electronic hardware blockdiagram






Zero act 02
Gain act 02
to O2 Cell
Gain PR
Zero PR
PR Relief Valve
Zero nom 02
Gain nom 02
Belastung
Speisung
Display Board Babyvent
Schema Analog
HAMILTON MEDICAL AG
SA 604.598
03


0cm H2O
1cm H2O
2cm H2O
3cm H2O
4cm H2O
5cm H2O
6cm H2O
7cm H2O
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9cm H2O
10cm H2O
11cm H2O
12cm H2O
AL_ENA
L_PRES
H_PRES
L_O2
H_O2
Display Board Babyvent
Schema Digital
HAMILTON MEDICAL AG
SA 604.598

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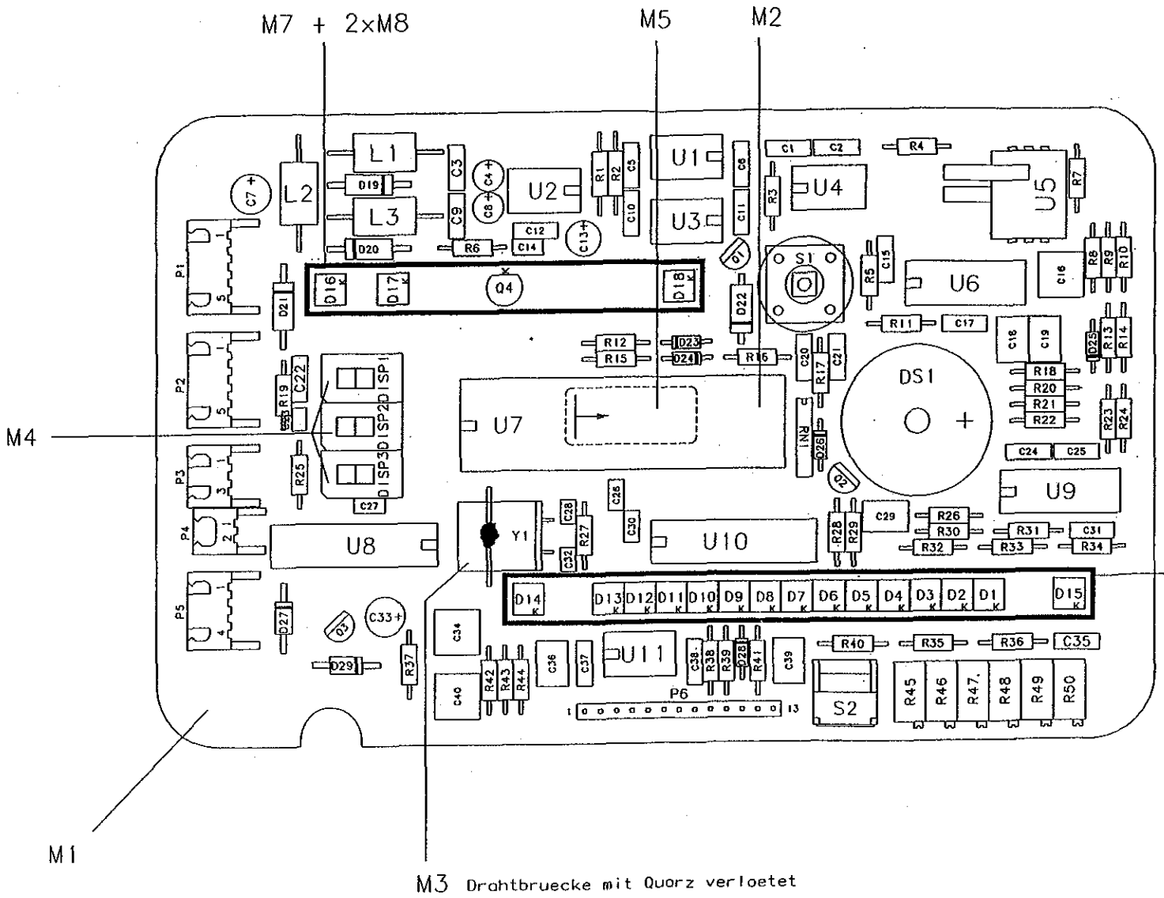

Aend.Nr.	---	8418	8446	8460		
Datum	98-05-27	98-10-23	98-11-23	98-11-27		
Name	D. Marty	C. Geret	C. Geret	C. Geret		

Display Board Babyvent	Massstab 1.5 bei A3	BPL	158.201	Blatt 1	
Bestueckungsplan		SA	604.598	von 1	
		Gez.	Demian Marty	1998-04-22	
		Gepr.			Rev.
HAMILTON MEDICAL AG		BSP 158.200			03

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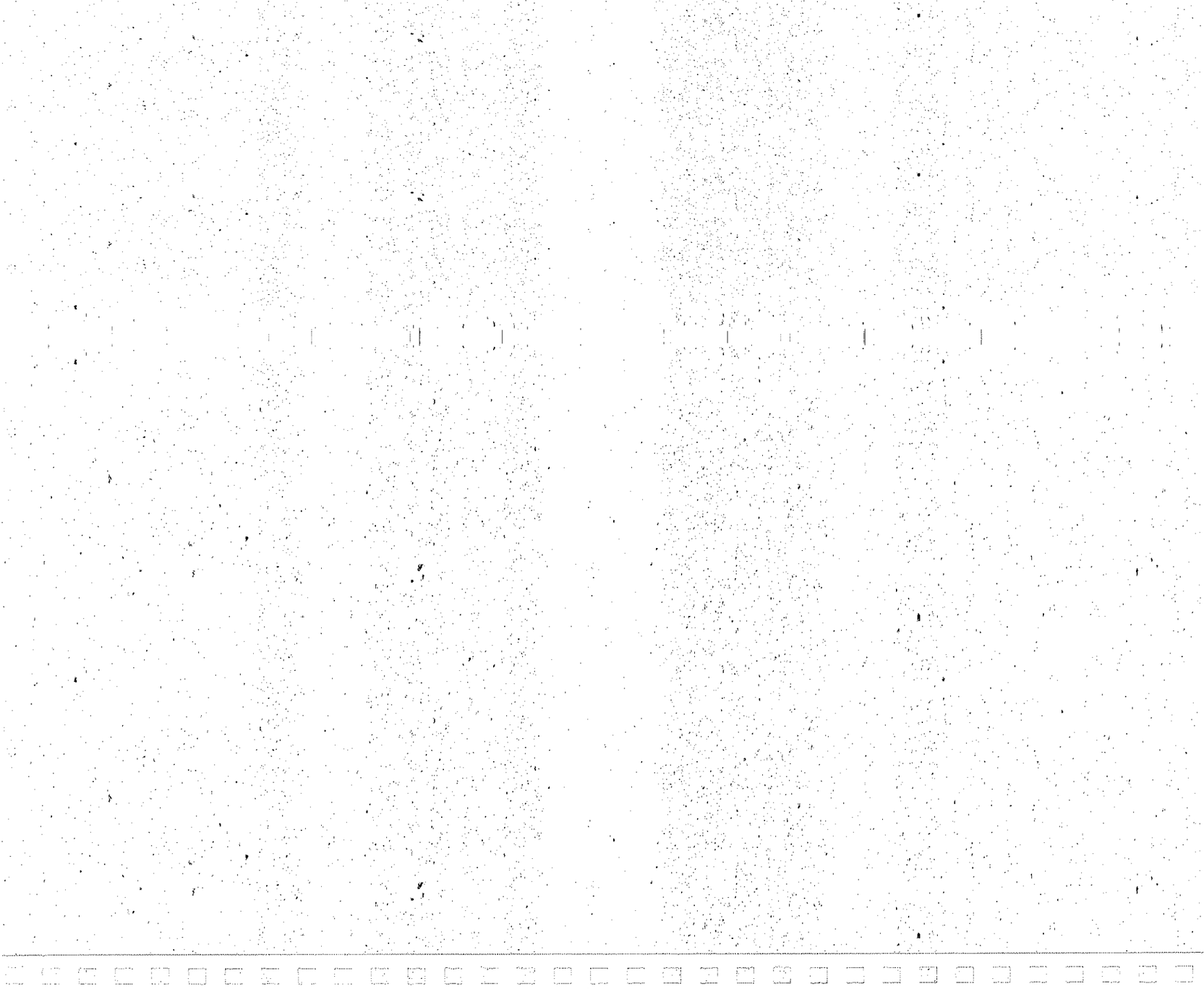
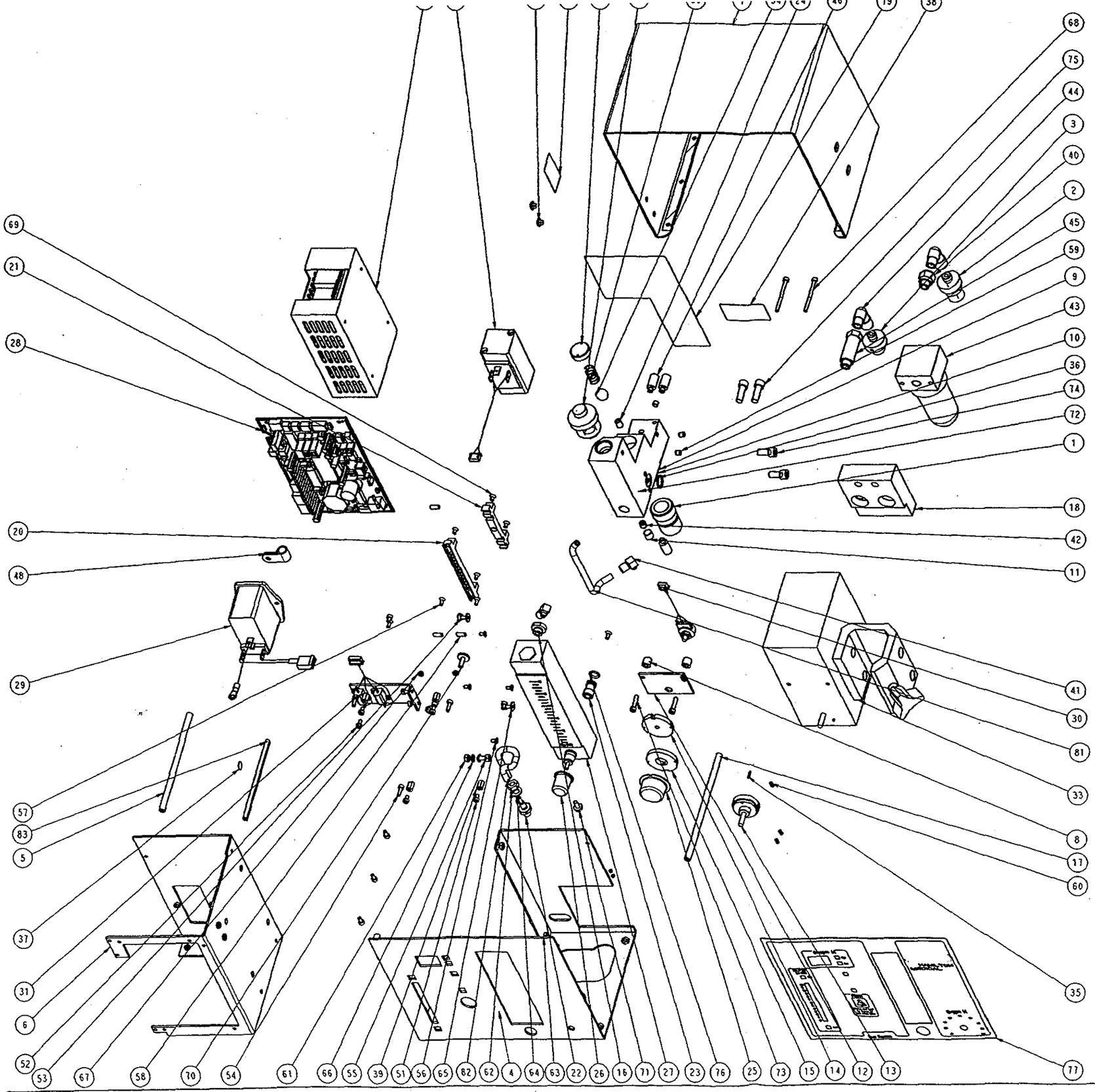
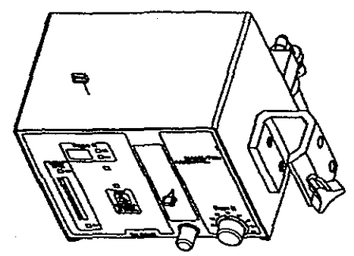
C.-Del







7/20

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82	7249068_	Messschlauch	1	Silikon	
81	7249072_	Schlauch	1		Festo
80	256128_20_0	Druckfeder YD-0906-12	1	1.4301	
79	255761_WARNING	Labelsel	1		
78	255761_PARAMETER	Etikette	1		
77	255761_FRONTFOLIE	Labelsel	1		
76	16191_1.5	O-Ring	1	NBR	
75	420557	ZYL.SCHR.M.I-GEW. 1/4-20X3/4"	2	CrNiMo	
74	420556	ZYL.SCHR.M.INBT.1/4-20X1/2"	2	CrNiMo	
73	420555	ZYL.SCHR.M.INBT.6-32X5/8"	2	CrNiMo	
72	420554	ZYL.SCHR.M.INBT.8-32X1/4"	2	CrNiMo	
71	420549	Zyl Schr m. Fle. M4x8	2	1.0037	doccrosilisiert
70	420534	FLACHKOPFSCHRAUBE M4X12 DIN921	1	1.0037	
69	420496	SENKSCHRAUBE M3X6 DIN7991	1	1.0037	
68	420462	ZYLINDERSCHRAUBE M3X40 DIN912	2	1.0037	
67	420436	EINPRESSMUTTER M3	2	1.0037	
66	415902	Federscheibe A4 DIN6796	2	Stahl	
65	405290	V-SCHEIBE M3 DIN99210	2	1.0037	
64	405100	V-SCHEIBE M6	1	1.0037	
63	406105	EINPRESSMUTTER M4	1	1.0037	
62	406006	SECHSKANTMUTTER M6	1	1.0037	
61	406096	SECHSKANTMUTTER M4	1	1.0037	
60	405441	GEWINDEST. M3X3 VERZ. DIN916	6	1.0037	
59	405062	GEWINDEST. M3X5 VERZ. DIN913	3	1.0037	
58	405065	GEWINDEST. M4X10 VERZ. DIN913	3	1.0037	
57	403453	SENKSCHRAUBE M3X8 DIN7991	4	1.4305	
56	403452	SENKSCHRAUBE M3X6 DIN7991	4	1.4305	
55	406425	ZYLINDERSCHRAUBE M4X10 DIN912	1	1.0037	
54	406094	ZYLINDERSCHRAUBE M3X10 DIN912	3	1.0037	
53	406093	ZYLINDERSCHRAUBE M3X8 DIN912	2	1.0037	
52	406092	ZYLINDERSCHRAUBE M3X6 DIN912	8	1.0037	
51	406091	ZYLINDERSCHRAUBE M3X5 DIN912	8	1.0037	
50	396149	Netzteil +5/+15VDC 40W	1	-	
49	396000	Sauerstoffzelle Catalyst	1	Alu	
48	361021	KABELBRTEST(CONN CX-9	1	PA	
47	281269	Abdeckkappe D=4.75	2	PA	
46	281071	Schalldämpfer	3	Stahl	
45	219707	Distanznippel 1/8"	1	Rippel	
44	219706	Winkelstueck	2	Stahl	
43	219477	Feinfilter 50M	1	Diverse Mat.	
42	219443	Restrictor 250	1		
41	219501	Mini-Schnellverschraubung	2	Stahl	
40	219505	Reduziernippel konisch	1	Rippel	
39	257036	DISTANZHALTER M3X8 I/I-GEWINDE	4	2.0370	
38	255356	3M Etikette MEDICAL	1		
37	255044	Trägungskleber	1		
36	254030	O-Ring	1	NBR	
35	251032	ZYLINDERSTIFT 2X8 DIN6325	1	1.0037	
34	250031	KUGEL D=12	1	1.0037	
33	235705	Air-Oxygen Mixer	1	-	
32	158216	Magnetventil kompl.	1		
31	158215	Leistungsmelderstecke	1		
30	158214	Potentiom. konfektioniert	1		
29	158211	Betriffer konfektioniert	1		
28	158200	Displayboard	1		
27	158141	Reluncter	1	PHAL	
26	158139	Reluncterknopf	1	AA 6012 T6	
25	158138	Mischerknopf	1	AA 6012 T6	
24	158137	Gewindebuchse	1	2.0401	
23	158136	Anschluss	1	2.0401	
22	158135	Messanschluss	1	2.0401	
21	158134	Halterlage 2	1	AA 6060 T6	
20	158133	Halterlage 1	1	AA 6060 T6	
19	158132	Einstellring	1	2.0401	
18	158131	Adapter	1	AA 6082 T6	
17	158129	Distanz 2	1	AA 6012 T6	
16	158128	Verbinder	1	2.0401	
15	158127	Zahnrad	1	2.0401	
14	158126	Zahnrad	1	2.0401	
13	158125	Kupplung	1	2.0401	
12	158124	Lagerplatte	1	AA 5005 H24	
11	158123	Stopfen	1	AA 6012 T6	
10	158121	Block	1	AA 5083 H111	
9	158120	Block kpl.	1		
8	158119	Distanzbuchse	2	AA 6012 T6	
7	158114	Verschalung	1	Alu	
6	158113	Einsatz	1	Alu	
5	158112	Distanz	1	AA 6012 T6	
4	158111	Boden	1		
3	155205	O2 - Anschluss DISS	1	AA 6012 T6	
2	155199	Luftanschluss DISS	1	AA 6012 T6	
1	151443	Anschlussstutzen 1	1	2.0401	
Pos.	Artikelnr.	Kunz/Bezeichnung	Stk.	Material	Bemerkungen

Material	Oberflaeche
	√(√)

Driver	Massstab 1/2	Nicht tol. ± / Masse	Blatt 1 von 1	
	Ers. f.	Gez. oms/	1997-11-17	
	Ers. durch	Gepr.	98-02-2	
HAMILTON MEDICAL AG	ZCH158100		Rev. 01	

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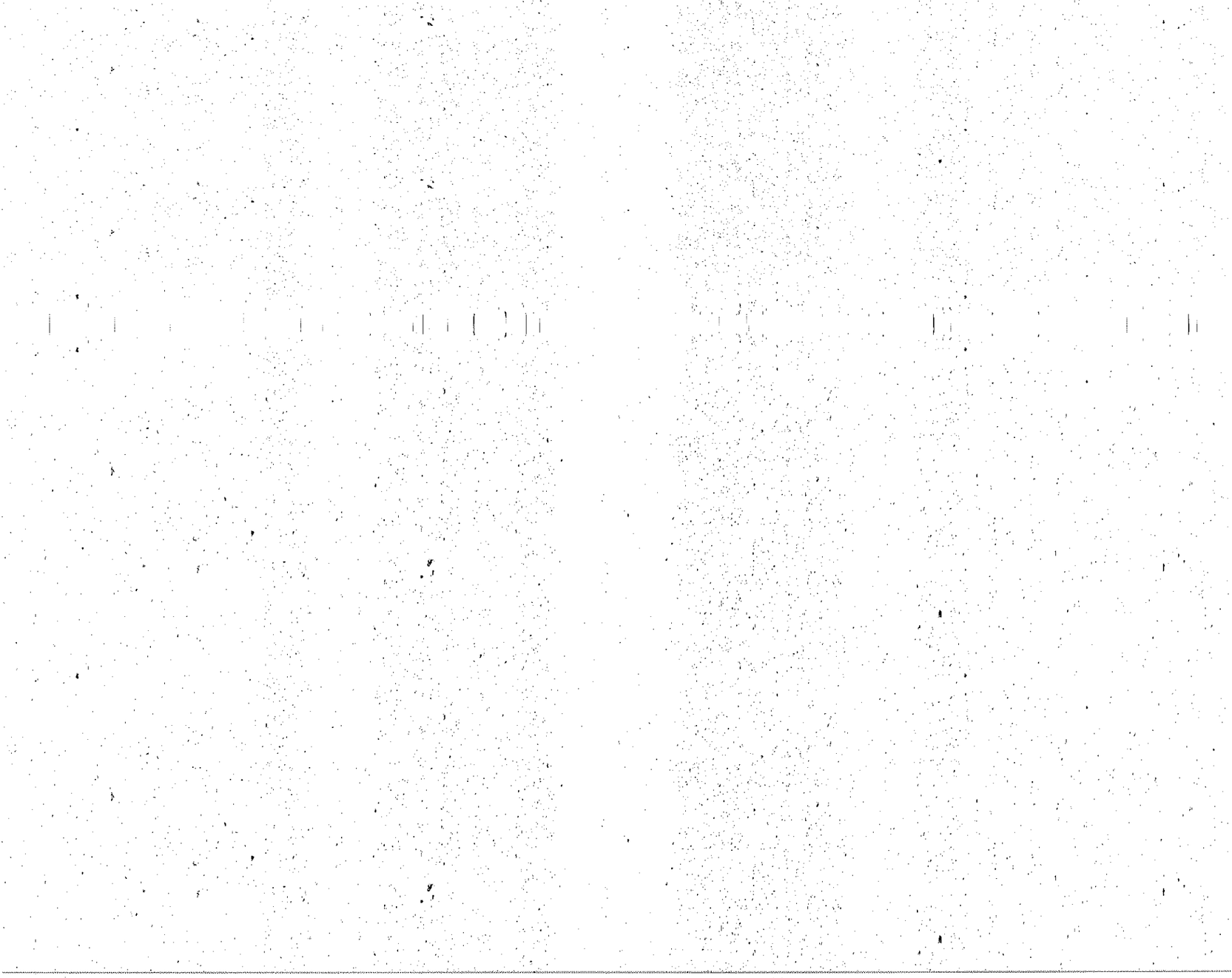

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